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Original Article

Chemical Profiling of *Mangifera indica* Leaf and *Mucuna pruriens* Seed Extracts: A Phytochemical and Gas Chromatography-Mass Spectrometry-Based Study

Mohamad Qutboddin[1,2], Syed Sagheer Ahmed[1,*], Pooja Rangenahalli Chidananda Murthy[1], Mohammad Ali[1], Bharathi Doddla Raghunathanaidu[1]

[1]Department of Pharmacology, Faculty of Pharmacy, Sri Adichunchanagiri College of Pharmacy, Adichunchanagiri University, B. G Nagara, Karnataka, INDIA.
[2]Department of Pharmacology, Akshaya Institute of Pharmacy (Affiliated to Rajiv Gandhi University of Health Science, Bengaluru), Tumkur, Karnataka, INDIA.

ABSTRACT

Background: Medicinal plants remain an essential source of therapeutic agents due to their abundant phytochemicals and pharmacological attributes. *Mangifera indica* (mango) leaves and *Mucuna pruriens* (velvet bean) seeds are renowned in traditional medicine for their antioxidant and neuroprotective properties. Scientific validation of their bioactive compounds is vital to support their medicinal uses. **Aim and Objectives:** This study aimed to authenticate, extract, and chemically profile *M. indica* leaves and *M. pruriens* seeds, as well as to evaluate their antioxidant potential. The specific objectives were: (i) Authentication of plant material, (ii) Extraction of phytoconstituents, (iii) Preliminary phytochemical screening, (iv) Assessment of antioxidant activity using the DPPH assay, and (v) Identification of bioactive compounds through Gas Chromatography-Mass Spectrometry (GC-MS). **Materials and Methods:** Authenticated plant materials were subjected to Soxhlet extraction with ethanol. Preliminary phytochemical tests were performed to identify major classes of secondary metabolites. Antioxidant activity was assessed using the DPPH radical scavenging assay. Chemical constituents were identified through GC-MS analysis. **Results:** Phytochemical screening revealed the presence of alkaloids, flavonoids, tannins, phenols, saponins, and terpenoids in both extracts. The DPPH assay showed significant radical scavenging activity, which increased with concentration. GC-MS profiling identified various bioactive compounds, including notable ones in *Mangifera indica* leaf extract such as Thymol, Methylcarbamate derivative of 3-methyl-5-isopropylphenol methylcarbamate, 2-methyl-5-isopropylphenol, alpha-farnesene with (Z,Z) stereochemistry, beta-farnesene with (E) configuration, -cis-β-Farnesene, 6-Methyl-2-methylene-6-(4-methylpent-3-en-1-yl)bicyclo[3.1.1]heptane (1R,5R,6S)-isomer, (1R,5R)-2-Methyl-5-[(R)-6-methylhept-5-en-2-yl]bicyclo[3.1.0]hex-2-ene, and Oxalic acid, allyl hexadecyl ester. The extract from *Mucuna pruriens* seeds contained significant components such as 1) ethyl undecanoate, 2) ethyl decanoate, 3) methyl 2-methyloctanoate, 4) ethyl 10-bromodecanoate, and 5) 2-ethylheptanoic. Free fatty acids, including decanoic and undecanoic acids, are known for their antifungal, antibacterial, and anticonvulsant properties. **Discussion:** The present findings corroborate the traditional uses of *Mangifera indica* and *Mucuna pruriens* as natural sources of bioactive antioxidants. The phytochemical diversity, along with the statistically significant antioxidant activity demonstrated in the DPPH assay, provides a strong basis for their continued investigation as therapeutic agents. **Conclusion:** The findings highlight the phytochemical diversity and strong antioxidant potential of *Mangifera indica* leaves and *Mucuna pruriens* seeds. These results validate their traditional use and provide a scientific basis for further pharmacological and therapeutic research.

Keywords: DPPH scavenging activity, Gas chromatography-mass spectrometry, *Mangifera indica*, *Mucuna pruriens*.

Correspondence:
Dr. Syed Sagheer Ahmed
Department of Pharmacology, Faculty of Pharmacy, Sri Adichunchanagiri College of Pharmacy, Adichunchanagiri University, B. G Nagara-571448, Karnataka, INDIA.
Email: sysaha6835@gmail.com

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INTRODUCTION

Mangoes, scientifically known as *Mangifera indica*, are part of the Mangifera genus within the Anacardiaceae family, which falls under the Sapindales order. These trees thrive in numerous locations worldwide, particularly in tropical areas (Parvez, 2016). Mango trees are characterized by simple leaves that are alternately

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positioned and measure between 15 and 45 cm in length. The petiole, which is consistently swollen at its base, ranges from 1-12 cm in length (Hill, 1963). Mangoes can weigh up to 700 g. *Mangifera indica* is renowned for its wide range of therapeutic benefits, including antihyperlipidemic, hepatoprotective, anticancer, anti-inflammatory, antidiarrheal, and antimicrobial properties (Saleem *et al*., 2019; Kumar *et al*., 2021). Mangoes are rich in phytochemicals and nutrients (Ajila and Rao, 2008; Parvez, 2016). In addition, the peel and pulp of mangoes are rich in carotenoids and polyphenol pigments (Gebhardt *et al*., 2006). The mango skin is abundant in biologically active pigments, including carotenoids such as beta-carotene, a provitamin A compound, as well as lutein and alpha-carotene (Gouado *et al*., 2007). Mangoes also contain polyphenols (Mahattanatawee *et al*., 2006; Singh *et al*., 2004), such as rutin, myricetin, flavanols, and the unique mango-derived xanthonoid mangiferin-C2-β-D-glucoside (Andreu *et al*., 2005). These compounds have been initially explored for their potential to mitigate various pathological conditions (Percival *et al*., 2006; Rodríguez *et al*., 2006). The levels of phytochemicals and nutrients appear to differ among various mango varieties (Ribeiro *et al*., 2007). *Mucuna pruriens* seeds, belonging to the Fabaceae family, are also referred to as Cowhage, Kowitch, or Kapikachu, owing to their physiological traits, therapeutic benefits, and pharmacological properties (Divya *et al*., 2017). The seeds of *Mucuna pruriens* have a smooth surface that can be dark brown, black, or occasionally mottled, with a thickness of approximately 0.5 mm, and they exhibit antiparkinsonian activity (Weiss *et al*., 2001). As a natural treatment for Parkinson's disease, *Mucuna pruriens* has shown significant neuroprotective potential (Manyam *et al*., 2004). Its aphrodisiac properties have also been documented (Gupta *et al*., 2011). The seeds and their primary component, L-DOPA, help restore spermatogenic function by counteracting oxidative stress, mitochondrial dysfunction, and apoptosis (Singh *et al*., 2013). Additionally, *Mucuna pruriens* seed extracts demonstrate anti-diabetic potential (Majekodunmi *et al*., 2011) and antioxidant activity in various *in vitro* models (Siddhuraju and Becker, 2003). Mood-enhancing effects have been observed in rodent models of depression (Pati *et al*., 2010), while methanolic seed extracts affect the immune response and exhibit anti-inflammatory properties in mice (Eze and Ndukwe, 2012).

The seeds are abundant in secondary metabolites, including phenolic compounds, tannins, saponins, isoprene derivatives, sugar derivatives, and steroid derivatives, which contribute to antioxidant activity, neuroprotection, and antimicrobial effects. Many studies have also concentrated on the stem bark of *Mangifera indica* (Sellés *et al*., 2021). Identified volatile compounds that could be linked to its health advantages. Similarly (Ayoola *et al*., 2020), found phytochemicals such as tannins, terpenoids, flavonoids, and alkaloids in mango bark (Osman and Ramlan, 2015). Employed GC-MS to analyze essential oils from three mango varieties, while (Helen *et al*., 2013) used gas chromatography-mass spectroscopy to identify various components (Singh *et al*., 2015). Isolated and characterized bioactive compounds from the stem bark (Glory *et al*., 2020; Pino, 2012). Investigated volatile compounds that contribute to mango aroma, pinpointing key odor-active molecules. In terms of seed phytochemistry (Saikarthik *et al*., 2017), used GC-MS analysis to reveal major fatty acid derivatives, and Shanmugavel and Krishnamoorthy (2018) confirmed the nutraceutical potential of *Mucuna pruriens* seeds (Kumar and Rajeshkumar, 2017). Emphasized their anti-inflammatory, antioxidant, and antibacterial properties. Finally (Chukwu *et al*., 2022), utilized LC-MS and GC-MS to profile multiple bioactive compounds, highlighting their therapeutic potential.

MATERIALS AND METHODS

Authentication

Mangifera indica leaves and *Mucuna pruriens* seeds were collected from the Tumkur area.

Authentication was performed by the pharmacognosy lab at FRLHT Bengaluru. The numbers 6565 and 6566 were authenticated.

Extraction

To prepare the extracts from *Mangifera indica* leaves and *Mucuna pruriens* seeds, each sample weighing 10 g shown in Figure 1 was processed with 150 mL of 80% ethanol using a Soxhlet extractor. The resulting extract was subsequently dried under reduced pressure using a rotary evaporator. The dried residue was then kept in a desiccator for future use (Harborne,1998).

Phytochemical test

Using established methods (Harborne, 1998), the extracts from *Mangifera indica* leaves and *Mucuna pruriens* seeds underwent initial phytochemical analysis to identify the presence of secondary metabolites.

Pharmacognostic Analysis

Determination of foreign matter

The leaf powder, dried in the shade, was dispersed in a thin coating, and any outside matter was removed either by visually inspecting it with a low-power magnifying glass (6× or 10×) or by using an appropriate sieve, and the findings were documented.

Physical properties

The nature, color, and odor were analyzed by visual observation and smell of the leaf powder, and the characteristics were noted.

Fluorescence analysis

A fluorescent lamp was mounted with appropriate filters that eliminated visible light from the lamp and selectively transmitted UV radiation of precise wavelengths. Fluorescence was checked after treating leaf powder with different acids and solvents.

Determination of percentage of ash

A pre-weighed silica dish was used to hold 2-3 g of leaf powder that had been dried in the shade. The dish was then subjected to a gradual increase in heat until all the carbon was removed, after which it was cooled and weighed again.

Acid in-soluble ash

The ash, for acid-insoluble ash estimation, was treated by refluxing with 25 mL of low-concentration Hydrochloric Acid (HCl) for 5-10 min. The insoluble material was then collected in a crucible, rinsed with hot water, ignited, and weighed later

Water soluble ash

The process of determining aqueous-soluble ash involves boiling the collected ash in water for 5-10 min. The non-dissolvable residue was then gathered in a crucible, rinsed in hot water, ignited, and subsequently weighed. The total water-soluble ash was calculated by subtracting the weight of the insoluble residue from the total ash weight.

DPPH scavenging activity

A stock solution of the leaf extract (20 µL) was diluted with 1.98 mL of methanol and blended with 2 mL of 0.16 mM DPPH solution. The reaction mixture was conditioned in the dark at 37°C for 30 min. A mixture containing only the sample buffer was used as the control. Following incubation, the absorbance was measured at 517 nm using a UV-Vis spectrophotometer, with a reagent blank as a reference. A sample blank was prepared by substituting DPPH with methanol (Duan *et al.*, 2006).

GC-MS analysis

Gas Chromatography-Mass Spectrometry (GC-MS) is an exceptionally efficient technique for separating and identifying complex phytochemical mixtures. Initially, gas chromatography is employed to separate the components of the mixture, and then each isolated component undergoes individual analysis using mass spectrometry. This approach can identify compounds in quantities as small as less than 1 mg. The process begins with the sample being injected into the Gas Chromatography device's injection port, where it is vaporized, followed by the separation and analysis of its various components. Ideally, each element creates a separate spectral apex that can be electronically documented on a paper chart. The duration from injection to elution is referred to as the "retention time," which aids in distinguishing between different compounds. The peak height was determined from the baseline to the apex. The oven temperature was set to 290.00°C, increasing at a rate of 10°C/min, with helium serving as the carrier gas at a flow rate of 1 mL/min. The sample was introduced using a split-sampling technique at a 1:10 ratio (Bai *et al.*, 2014; Sahu and Saxena, 2013).

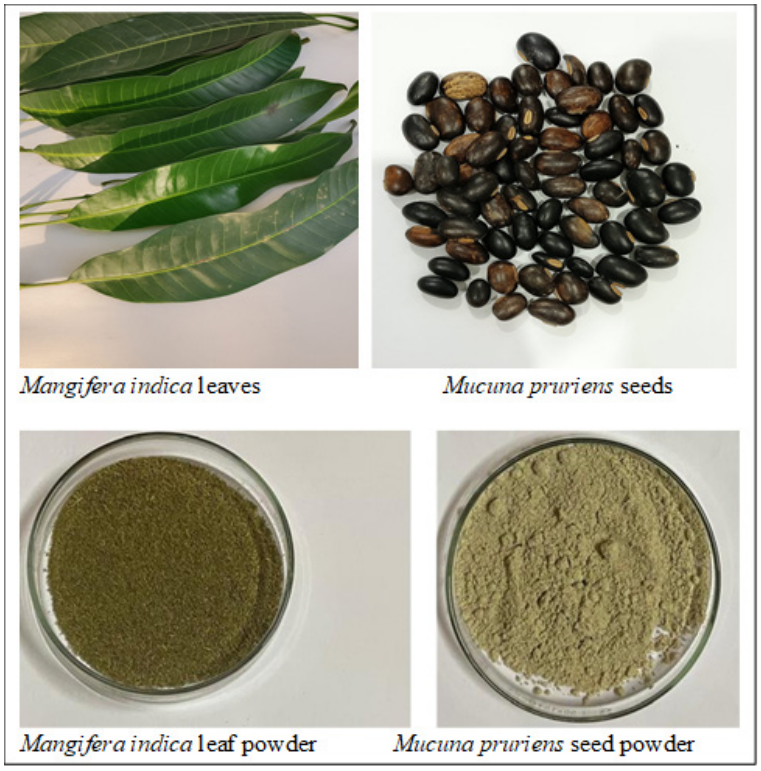


Figure 1: *A. Mangifera* indica Leaves and *Mucuna pruriens* seeds, *B. Mangifera* indica Leaf powder and *Mucuna pruriens* seed powder.

Statistical Analysis

All experiments were performed in triplicate (n = 3), and the data are expressed as Mean ± Standard Deviation (SD). Statistical analysis was carried out using GraphPad Prism 9.0. The normality of data was assessed using the Shapiro–Wilk test. Correlation between percent scavenging activity and total phenolic content (mg GAE/g) was evaluated using Pearson correlation analysis, and the coefficient of determination (R^2) was calculated.

RESULTS

The extraction yields from *Mangifera indica* leaves and *Mucuna pruriens* seeds were 28% and 23%, respectively. Phytochemical analysis revealed the presence of alkaloids, flavonoids, tannins, phenols, saponins, and terpenoids in both the extracts. The DPPH assay showed significant radical-scavenging activity, which increased with increasing concentrations. GC-MS analysis identified several bioactive compounds. The *Mangifera indica* leaf extract contained notable compounds such as Thymol, a Methylcarbamate derivative of 3-methyl-5-isopropylphenol methylcarbamate, 2-methyl-5-isopropylphenol, alpha-farnesene with (Z,Z) stereochemistry, beta-farnesene with (E) configuration, -cis-β-Farnesene, 6-Methyl-2-methylene-6-(4-methylpent-3-en-1-yl) bicyclo[3.1.1]heptane (1R,5R,6S)-isomer, (1R,5R)-2-Methyl-5-[(R)-6-methylhept-5-en-2-yl]bicyclo[3.1.0]hex-2-ene, and Oxalic acid, allyl hexadecyl ester. The *Mucuna pruriens* seed extract included significant components such as 1) ethyl undecanoate, 2) ethyl decanoate, 3) methyl 2-methyloctanoate, 4) ethyl 10-bromodecanoate, and 5) 2-ethylheptanoic. Free fatty acids, such as decanoic and undecanoic acids, are known for their antifungal, antibacterial, and anticonvulsant properties. DISCUSSION: The findings of this study highlight the phytochemical diversity and bioactive potential of the *Mangifera indica* leaves and *Mucuna pruriens* seeds. The high extraction yield, presence of various secondary metabolites, and significant antioxidant activity suggest that both plants are valuable sources of pharmacologically important natural compounds. The identification of specific terpenoids, phenolic derivatives, and fatty acid esters through GC-MS profiling provides scientific support for their traditional medicinal use and suggests their potential for developing therapeutic agents for oxidative stress-related disorders, infections, and neurological conditions. Further *in vitro* and *in vivo* research is needed to investigate their mechanisms of action, safety, and efficacy for potential clinical applications.

Preliminary test of *Mangifera indica* leaves and *Mucuna pruriens* seeds

The preliminary test of *Mangifera indica* leaves showed presence of carbohydrate, protein and amino acid, tannic and phenol, saponin, flavonoids, terpenoids, alkaloids, glycosides, cardiac glycosides and whereas, *Mucuna pruriens* seeds show carbohydrate, protein and amino acid, tannic and phenol, saponin, flavonoids, terpenoids, alkaloids are present shown in Table 1.

Pharmacognostic Analysis

The pharmacognostic analysis of *Mangifera indica* leaves and *Mucuna pruriens* seeds results showed in Tables 2-4.

DPPH scavenging activity

Antioxidant activity was evaluated using the DPPH method. DPPH is a stable compound that pairs with a hydrogen donor and is reduced to DPPH-H^+; consequently, the absorption decreases, and decolorization occurs. An increase in electron

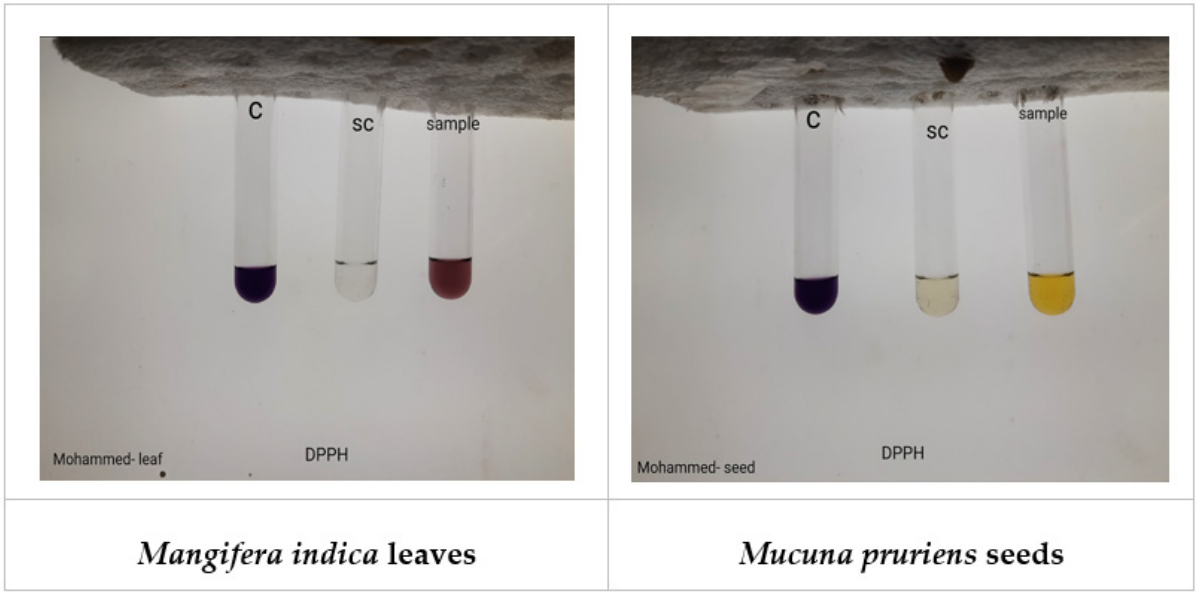


Figure 2: DPPH scavenging activity of *Mangifera indica* leaves and *Mucuna pruriens* seeds.

Table 1: **Preliminary test of *Mangifera indica* leaves and *Mucuna pruriens* seeds.**

Parameter	Test	Seed	leaf
Carbohydrate	Benedict's	Found	Found
Proteins and amino acids	Biuret	Found	Found
Tannins and phenol	$FeCl_3$	Found	Found
	Gelatin	Found	Found
Saponin	Foam	Found	Not found
Flavonoid	Lead acetate	Found	Found
Terpenoids	Salkowski's	Found	Found
Alkaloids	Dragendorff's	Found	Found
Glycosides	Liebermann's	Found	Not found
Cardiac glycosides	Keller kiliani's	Found	Not found
Steroids	Liebermann-burchard's	Not found	Not found

Table 2: **Preliminary characteristics of *Mango Leaf* powder and *Mucuna seeds* powder.**

Sl. No.	Tests	Parameter	Mango Leaf	Mucuna seed
1	Characteristics	Morphology	Mature leaves with long elliptical, pointed ends and smooth surface. 20-22 cm long dark green in colour	Solid bean shaped seeds, dark black colour with smooth texture
2	Foreign matters		Very few solid mid rib particles	No, sample was fine powder
3	Physical	Nature	Fine powder	Fine powder
4		Color	Dark greenish	Light green
5		Odor	Characteristic	Characteristics
6	Ash values (% w/v)	Total ash	12.29±0.11	4.2±0.12
7	Acid in-soluble ash (% w/v)	Acid in soluble	8.2±0.88	0.95±0.09
8	Water soluble ash (% w/v)	Water soluble	12.07±0.42	1.66±0.10

Ash Values are expressed as the means of three replicates±Standard Deviation (SD), n=3

Standard graph for DPPH scavenging activity

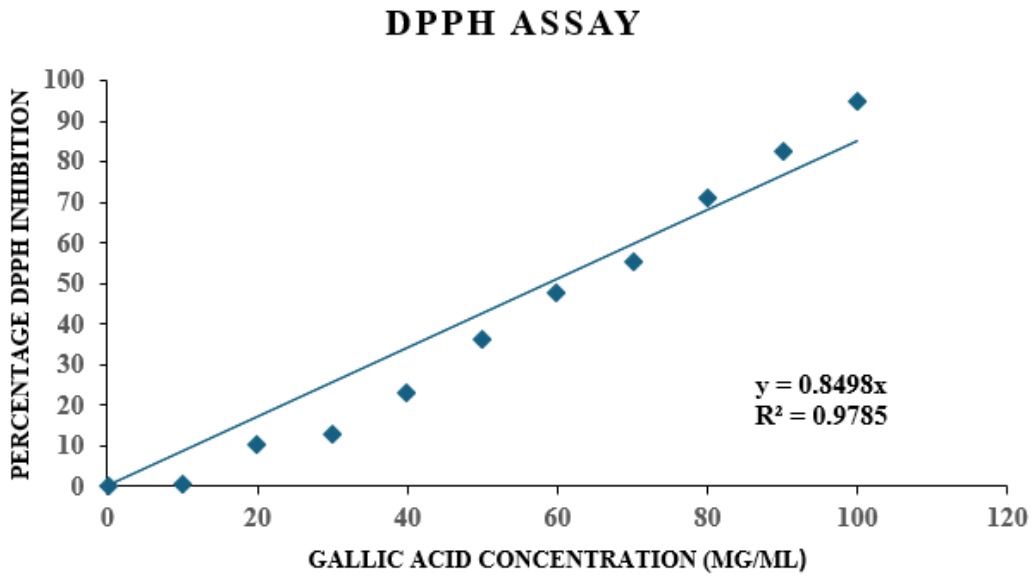


Figure 3: Standard graph of Gallic acid at different concentrations on DPPH assay. As shown in Figure 3 the calibration curve of gallic acid in the DPPH assay exhibited a linear relationship between concentration and percentage inhibition (y=0.8498x, R^2=0.9785, p<0.001). The high correlation coefficient (r=0.989) confirmed the strong linearity and reliability of the assay for antioxidant quantification.

Table 3: Fluorescence analysis of mango leaves.

Treatment	Leaf	
	UV254	UV365
Powder as such	Non-fluorescent	Non-fluorescent
Powder+Conc. HCl	Non-fluorescent	Light green fluorescence in the border
Powder+1M NaOH	Lightish green fluorescence in the border	Non-fluorescent
Powder+ethanol	Lightest green fluorescence spotted	Light green spotted fluorescence
Powder+acetic acid	Non-fluorescent	Non-fluorescent
Powder+methanol	Non-fluorescent	Light green spotted fluorescence
Powder+1M H_2SO_4	Light green fluorescence spotted	Boarder light green fluorescence
Powder+petroleum ether	Non-fluorescent	Non-fluorescent
Powder+water	Non-fluorescent	Non-fluorescent

capture leads to more pronounced decolorization and a higher reducing potential. were observed. Table 5. explained that the percent inhibition of *Mangifera indica* leaves was 59.46 and that of *Mucuna pruriens* seeds was 95.02., respectively. Also, standard gallic acid graph is plotted at different concentration showed in Figures 2 and 3. The regression value of gallic acid found to be 0.94.55.

GC-MS tabulation of bioactive molecule on *Mangifera indica* leaf

As shown in Figure 4, GC-MS analysis of *Mangifera indica* leaves revealed 11 major constituents, including Thymol; Phenol, 3-methyl-5-(1-methylethyl)-, methylcarbamate; Phenol, 2-methyl-5-(1-methylethyl);(Z,Z)-α-Farnesene;(E)-β-Farnesene; cis-β-Farnesene; (+)-2-Carene, 4-α-isopropenyl; trans-α-Bergamotene; Bicyclo[3.1.1]heptane, 6-methyl-2-methylene-6-(4-methyl-3-pentenyl)-,[1R-(1α,5α,6β)], (1R,5R)-2-methyl-5-((R)-6-methylhept-5-en-2-yl) bicyclo[3.1.0]hex-2-ene; and Oxalic acid, allyl hexadecyl ester, as summarized in Table 6.

Bioactive chemical constituent of ethanolic *Mangifera indica* leaf

GC-MS analysis of *Mucuna pruriens* seeds identified five primary components: ethyl undecanoate, ethyl decanoate, methyl 2-methyloctanoate, ethyl 10-bromodecanoate, and 2-ethylheptanoic acid tabulated showed in Table 7. And Figures 6 and 7.

Table 4: Fluorescence analysis of Mucuna seeds.

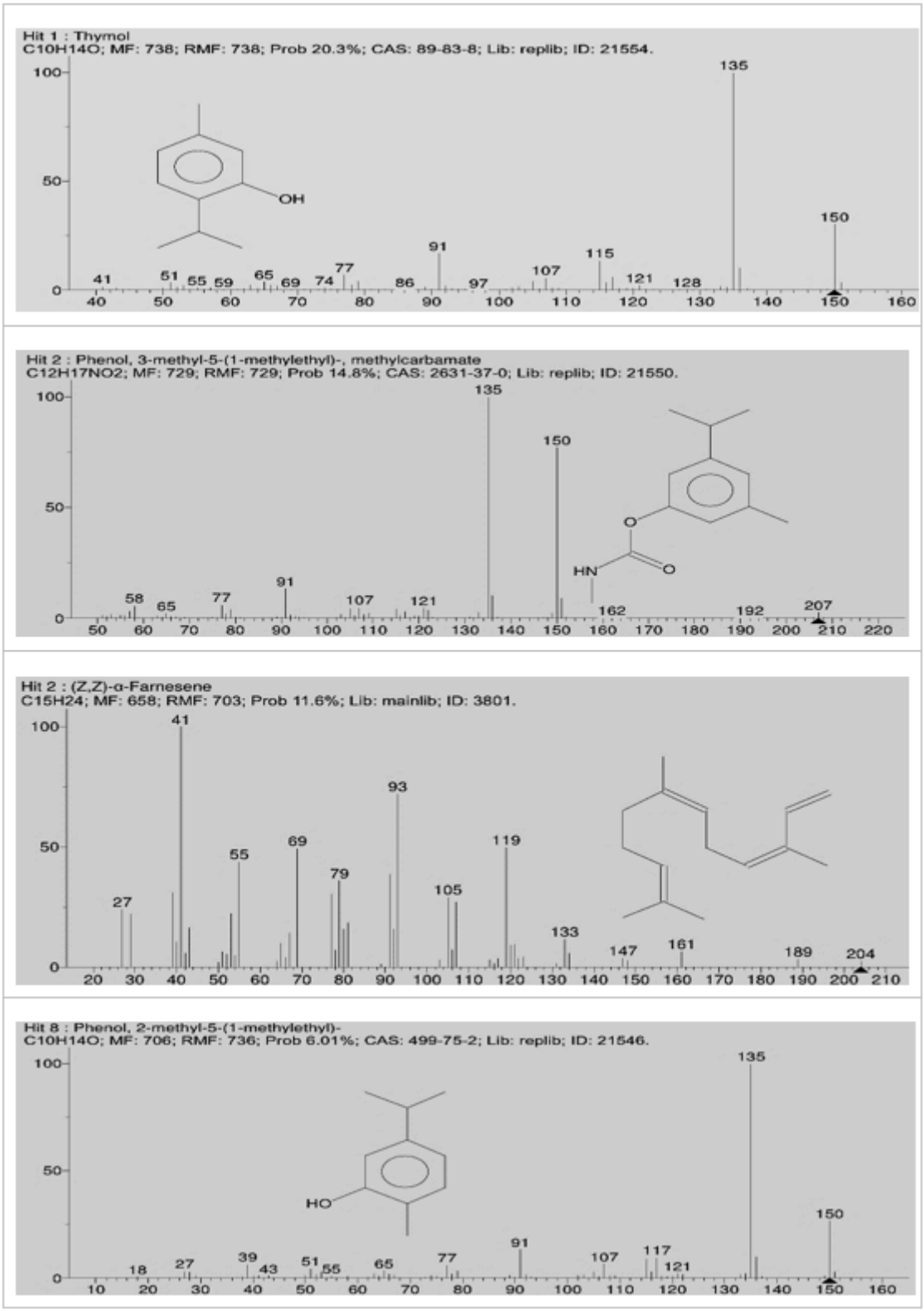
Treatment	Seeds	
	UV254	UV365
Powder as such	Non-fluorescent	Non-fluorescent
Powder + Conc. HCl	Light green fluorescence spotted	Non-fluorescent
Powder + 1M NaOH	Non-fluorescent	Non-fluorescent
Powder + ethanol	Lightish green border fluorescence	Slight green border spotted fluorescence
Powder + acetic acid	Non-fluorescent	Non-fluorescent
Powder + methanol	Non-fluorescent	Non-fluorescent
Powder + 1M H_2SO_4	Non-fluorescent	Non-fluorescent
Powder + petroleum ether	Slight green spotted fluorescence	Non-fluorescent
Powder + water	Non-fluorescent	Non-fluorescent

DISCUSSION

The present findings corroborate the traditional uses of *Mangifera indica* and *Mucuna pruriens* as natural sources of bioactive antioxidants. The phytochemical diversity, along with the statistically significant antioxidant activity demonstrated in the DPPH assay, provides a strong basis for their continued investigation as therapeutic agents. Future studies focusing on isolation of active compounds, structure–activity relationship analysis, and *in vivo* validation of neuroprotective efficacy will be valuable for developing novel plant-based antioxidants or adjunct therapies. The preliminary phytochemical screening of both *M. indica* leaves and *M. pruriens* seeds confirmed the presence of a wide spectrum of secondary metabolites such as alkaloids, flavonoids, phenols, tannins, saponins, and terpenoids. These classes of compounds are well-known for their biological activities, including antioxidant, anti-inflammatory, antimicrobial, and neuroprotective effects The antioxidant potential of the extracts was evaluated using the DPPH radical scavenging method. Results revealed that both plant extracts exhibited strong antioxidant activity, with *M. pruriens* seeds showing a higher percent inhibition (95.02%) compared to *M. indica* leaves (59.46%). This suggests that *M. pruriens* seed extract is particularly potent in neutralizing free radicals, which may be attributed to its rich content of fatty acids and other antioxidant phytochemicals. GC-MS profiling provided detailed insights into the chemical composition of the ethanol extracts.

The leaf extract of *Mangifera indica* showed several major constituents such as Thymol, Phenol, 3-methyl-5-(1-methylethyl)-, methylcarbamate, Phenol, 2-methyl-5-(1-methylethyl), (E)-β-Farnesene. These constituents proved to

Bioactive molecule graph of GC-MS characterization of the ethanolic extract of *Mangifera indica* leaf



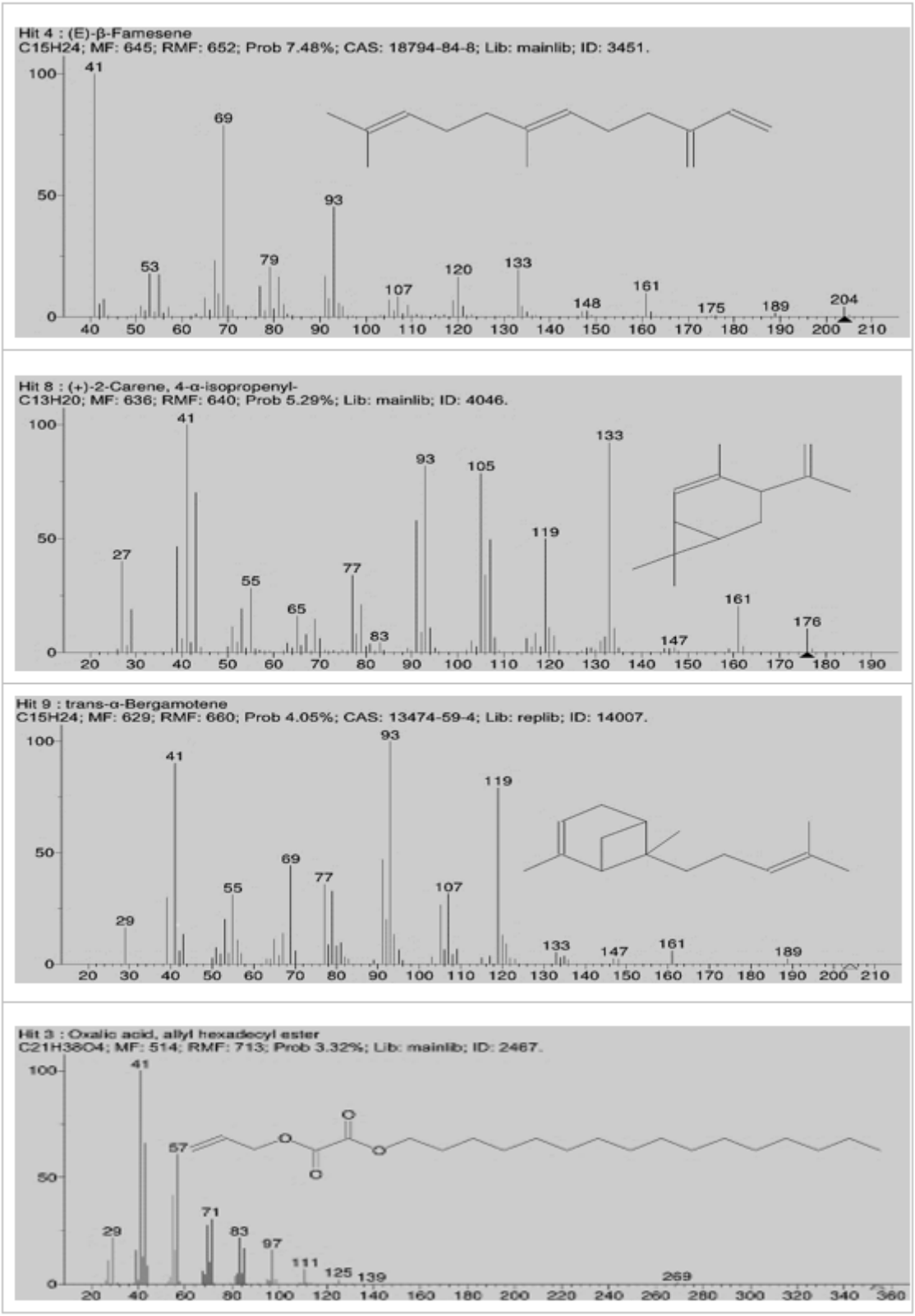


Figure 4: Mass Spectra of Leaf extract of *Mangifera indica* (ethanol-based).

have Antimicrobial, antioxidant, anti-inflammatory, antifungal, antiseptic, insecticidal, CNS modulating effects.

The seed extract of *M. pruriens* revealed major constituents such as Ethyl undecanoate,Ethyl decanoate, Methyl 2-methyloctanoate. These compounds, primarily fatty acid esters and derivatives, are recognized for their antifungal, antibacterial, and anticonvulsant activities. The presence of such molecules aligns with the known neuroprotective and antimicrobial properties of *M. pruriens*. The detection of free fatty acids like decanoic and undecanoic acid-well-known for membrane disruption in pathogens-further confirms its antimicrobial potential The pharmacognostic evaluations provided essential data for standardization, including ash values and fluorescence characteristics. These parameters serve as quality control indicators and can be used for the authentication and purity assessment of herbal raw materials. High extraction yields (28% for *M. indica*, 23% for *M. pruriens*) also highlight the efficiency of ethanol as a solvent in capturing bioactive compounds from both plant materials.

Table 5: DPPH scavenging activity of given extract.

Sample	Percent scavenging	Activity-mg GAE/g
Leaf	59.46	350.15±0.11
Seed	95.02	559.58±0.01

Values are expressed as the means of three replicates±Standard Deviation (SD), *n*=3, mg (GAE)/g represents mg gallic acid equivalents (CAE)/g dry extract

Table 6: Bioactive chemical constituent of ethanolic *Mangifera indica* leaf.

Name	MF	Mw	Peak %	RMF	Pharmacological Activity
Thymol	$C_{10}H_{14}O$	150	20.3%	738	Antimicrobial, antioxidant, anti-inflammatory, antifungal, antiseptic, insecticidal
Phenol, 3-methyl-5-(1-methylethyl)-, methylcarbamate	$C_{12}H_{17}NO_2$	207	14.8%	729	CNS modulating effects (carbamates may have insecticidal/acetylcholinesterase inhibitory activity)
Phenol, 2-methyl-5-(1-methylethyl)	$C_{10}H_{14}O$	150	6.01%	736	Antioxidant, antimicrobial
(Z,Z)-α-Farnesene	$C_{15}H_{24}$	204	11.6%	703	Antifungal, insect repellent (alarm pheromone in aphids), anti-inflammatory, flavoring agent
(E)-β-Farnesene	$C_{15}H_{24}$	204	7.48%	652	Antifungal, insect repellent (alarm pheromone in aphids), anti-inflammatory, flavoring agent
cis-β-Farnesene	$C_{15}H_{24}$	204	5.73%	644	Antifungal, insect repellent (alarm pheromone in aphids), anti-inflammatory, flavoring agent
(+)-2-Carene, 4-α-isopropenyl (terpens)	$C_{13}H_{20}$	176	5.29%	640	Antibacterial, anti-inflammatory, CNS depressant
trans-α-Bergamotene (terpens)	$C_{15}H_{24}$	204	4.05%	660	Antimicrobial, cytotoxic, insecticidal, anticancer potential
Bicyclo[3.1.1]heptane, 6-methyl-2-methylene-6-(4-methyl-3-pentenyl)-, [1R-(1α,5α,6β)]	$C_{15}H_{24}$	204	18.7%	687	Typically have insecticidal, antimicrobial, and possibly CNS effects
(1R,5R)-2-Methyl-5-((R)-6-methylhept-5-en-2-yl) bicyclo[3.1.0]hex-2-ene	$C_{15}H_{24}$	204	14.5%	686	antimicrobial, insecticidal, anti-inflammatory
Oxalic acid, allyl hexadecyl ester	$C_{21}H_{38}O_4$	354	3.32%	713	Antifungal, Antioxidant

Table 7: **GC-MS tabulation of bioactive molecule on *Mucuna pruriens* seeds.**

Name of the compound	MF	MW	Peak %	RMF	Pharmacological Activity
Undecanoic acid	$C_{13}H_{26}O_2$	214	15.6%	716	Antifungal, skin protectant, used in cosmetics and topical antifungals
Decanoic acid	$C_{14}H_{28}O_2$	228	7.57%	695	Anticonvulsant activity
Octanoic acid	$C_{10}H_{20}O_2$	172	5.95%;	678	Antibacterial, antifungal, used in fragrance and food industries
10-Bromodecanoic acid	$C_{12}H_{23}BrO_2$	278	5.06%;	673	anticancer, enzyme inhibitors (e.g., lipase) or membrane-disrupting agents
Heptanoic acid, 2-ethyl	$C_9H_{18}O_2$	158	22.1%	740	Used in cosmetics; antibacterial and possibly anti-inflammatory

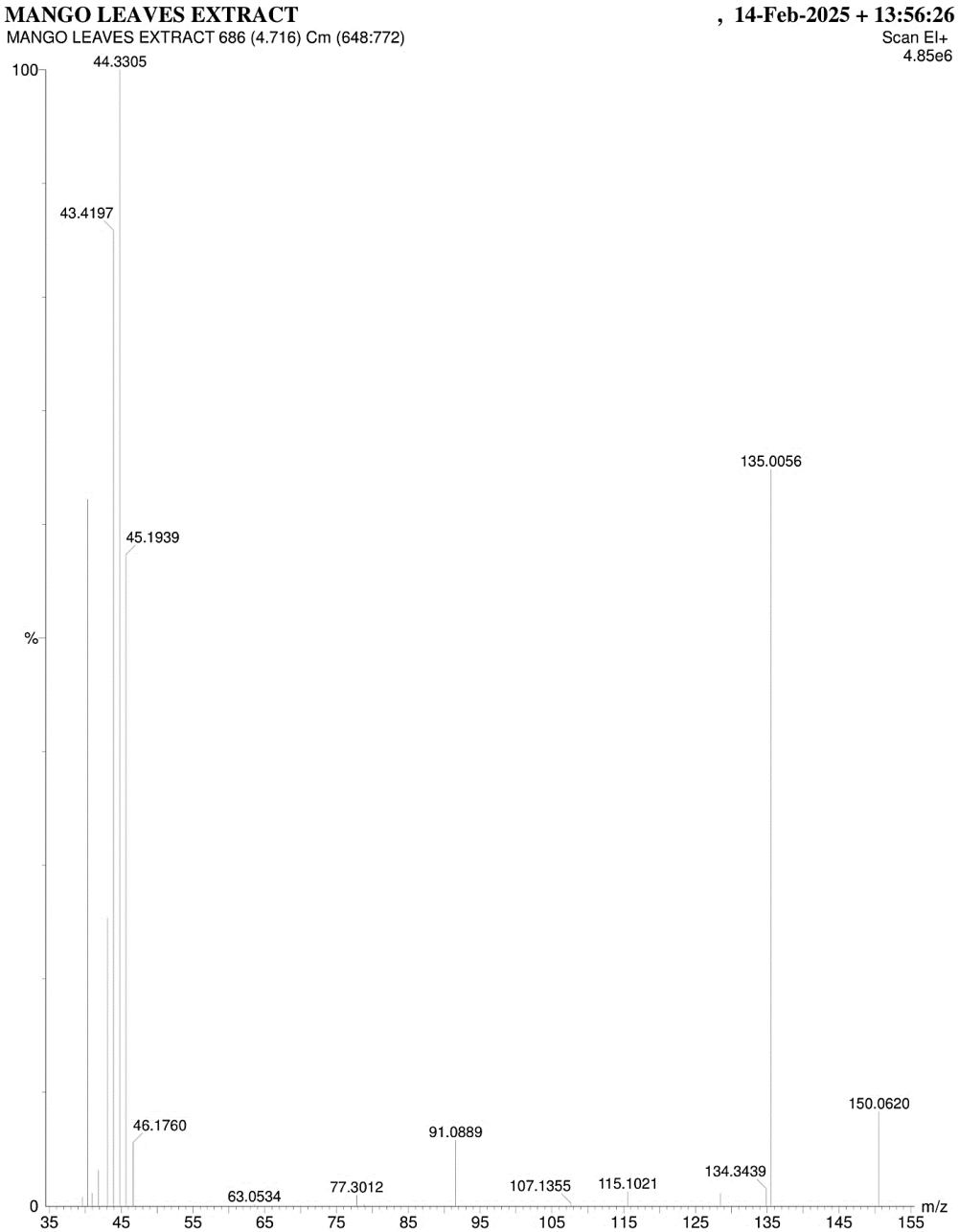


Figure 5: Gas Chromatogram of Ethanolic Extract *Mangifera indica* leaf. Figure 5 illustrates the chromatogram demonstrating the separation of phytochemical components found in the ethanolic extract of *Mangifera indica* leaves. Each peak represents a compound identified by its retention time, highlighting the intricate phytochemical composition of the extract.

Bioactive molecule graph of Gas- Chromatography and mass spectroscopy on Ethanolic Extract of *Mucuna pruriens* seeds

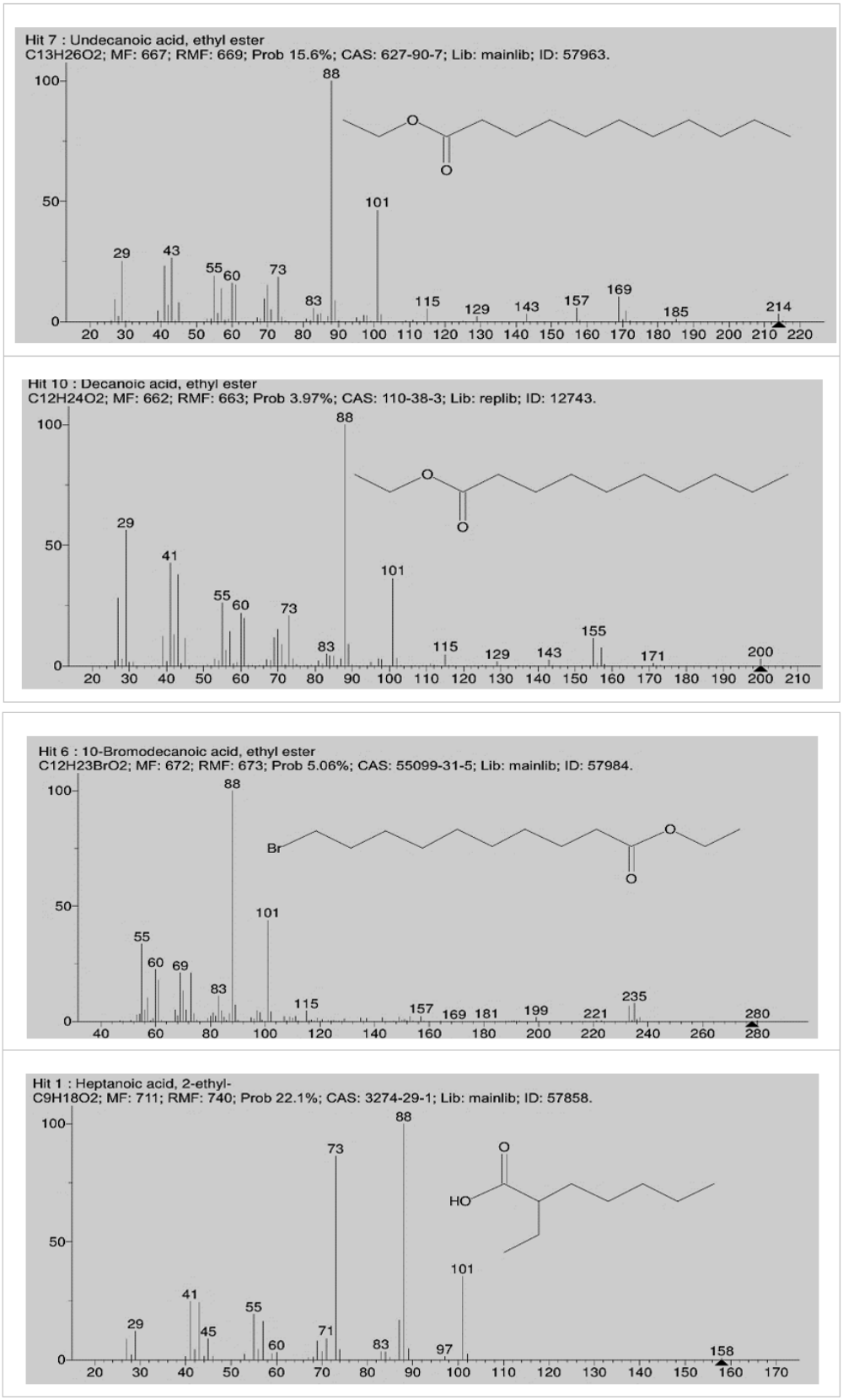


Figure 6: Mass Spectra of Seed extract of *Mucuna pruriens* (ethanol-based).

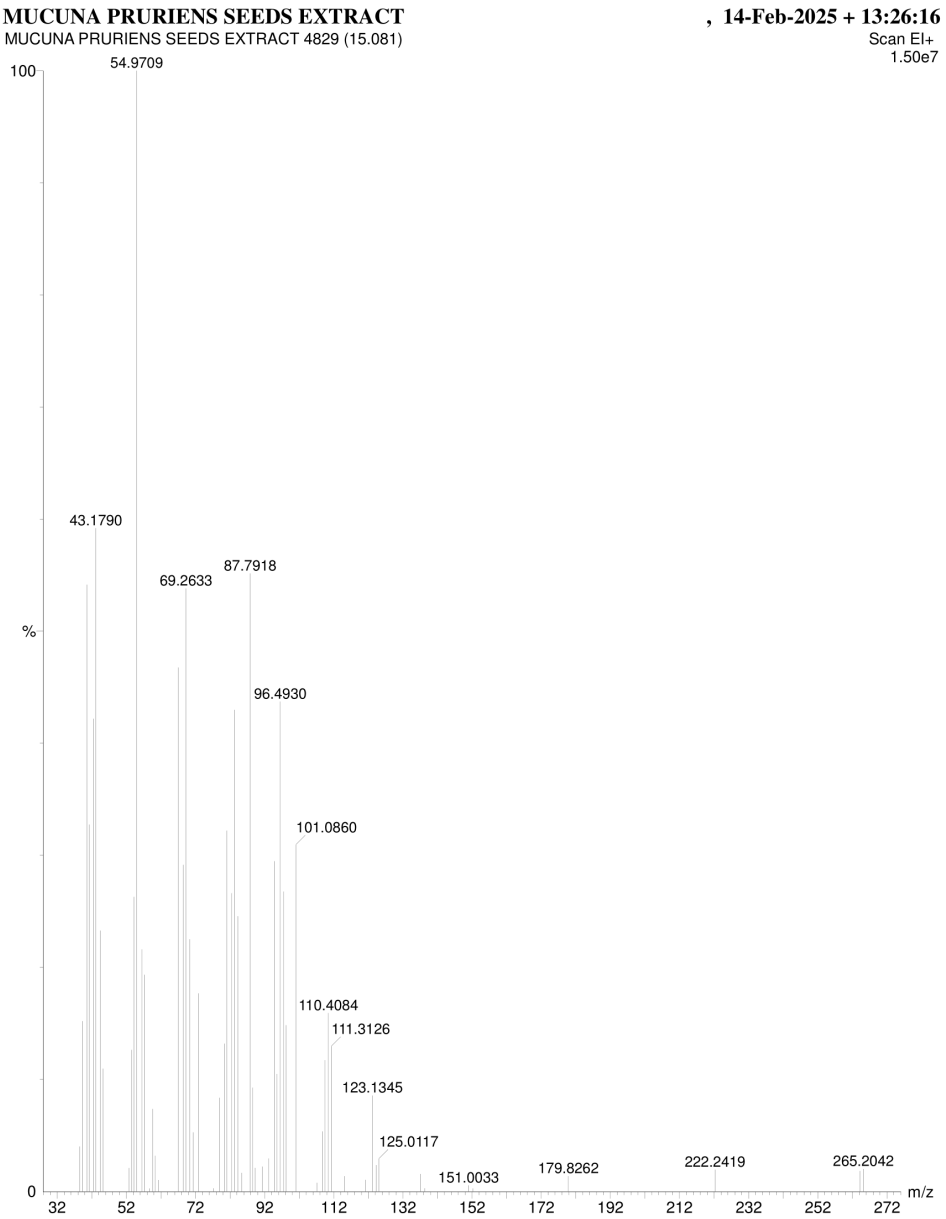


Figure 7: Gas Chromatogram of *Mucuna pruriens* seeds Ethanol Extract.

CONCLUSION

This study effectively demonstrated the abundant phytochemical content and chemical diversity present in the extracts of *Mangifera indica* leaves and *Mucuna pruriens* seeds through preliminary phytochemical analysis and GC-MS profiling. This study identified important secondary metabolites, including alkaloids, flavonoids, tannins, saponins, phenolics, and terpenoids, which validate the medicinal properties of these plants and support their traditional therapeutic uses. GC-MS profiling of *Mangifera indica* leaf extract revealed various bioactive compounds, such as phenolic derivatives, terpenoids, and farnesene-type sesquiterpenes, known for their antioxidant, anti-inflammatory, and antimicrobial properties. Similarly, the presence of medium-chain fatty acid esters and fatty acids, such as ethyl undecanoate and ethyl decanoate, in *Mucuna pruriens* seed extract confirms its established antifungal, antibacterial, and anticonvulsant effects. These findings affirm the pharmacological potential of both plant species as sources of natural bioactive compounds and highlight their importance in developing new phytopharmaceuticals.

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ABBREVIATIONS

GC-MS: Gas Chromatography and mass spectroscopy; **DPPH:** 2,3-Diphenyl picryl hydrazyl; **MI:** *Mangifera indica*; **MP:** *Mucuna pruriens*, **M. indica:** *Mangifera indica*; **M. pruriens:** *Mucuna pruriens*; **UV–vis:** Ultraviolet-visible; **GAE:** Gallic acid equivalent; **RMF:** Relative Mass Fraction; **MF:** Molecular Formula; **MW:** Molecular Weight; **CNS:** Central Nervous System.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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None.

AUTHOR CONTRIBUTIONS

Mohamad Qutboddin: Conceptualization, Experimental design, Methodology, Investigation, Data collection, Formal analysis, and Original draft preparation.

Dr. Syed Sagheer Ahmed: Supervision, Project administration, Conceptual guidance, Validation, and Critical review and editing of the manuscript. Pooja Rangenahalli Chidananda

Murthy: GC–MS analysis, Data interpretation, and Manuscriptreview.

Dr. Mohammad Ali: Phytochemical screening, Statistical analysis, and Data curation.

Dr. Bharathi Doddla Raghunathanaidu: Antioxidant assays, Laboratory support, and Literature review assistance.

SUMMARY

This study investigated the phytochemical composition, antioxidant capabilities, and chemical profiles of *Mangifera indica* leaves and *Mucuna pruriens* seeds. The extraction process yielded 28% for *M. indica* leaves and 23% for *M. pruriens* seeds, respectively. Preliminary phytochemical screening confirmed the presence of alkaloids, flavonoids, tannins, phenols, saponins, and terpenoids in both extracts, indicating a rich source of secondary metabolites. Antioxidant evaluation using the DPPH assay showed strong radical-scavenging activity that increased with concentration. GC-MS analysis identified several bioactive components. The *Mangifera indica* leaf extract contained notable compounds such as thymol, methylcarbamate derivatives, isomeric farnesenes, bicyclic terpenes, and oxalic acid esters. The *Mucuna pruriens* seed extract revealed various fatty acid esters and free fatty acids, including ethyl undecanoate, ethyl decanoate, and methyl 2-methyloctanoate. These compounds are associated with various biological activities, including antimicrobial, anti-inflammatory, and neuroprotective effects

REFERENCES

Ajila, C. M., and Rao, U. P. (2008). Protection against hydrogen peroxide induced oxidative damage in rat erythrocytes by *Mangifera indica* L. peel extract. *Food and Chemical Toxicology, 46*(1), 303-309.

Andreu, G. L. P., Delgado, R., Velho, J. A., Curti, C., and Vercesi, A. E. (2005). Mangiferin, a natural occurring glucosyl xanthone, increases susceptibility of rat liver mitochondria to calcium-induced permeability transition. *Archives of Biochemistry and Biophysics, 439*(2), 184-193.

Ayoola, A. A., Ekunseitan, D. A., Muhammad, S. B., Oguntoye, M. A., and Adejola, Y. A. (2020). Phytochemicals analysis and GC-MS determination of ethanolic extracts of *Azadirachta indica* and *Mangifera indica* stem bark and their biological potentials. *Pacific Journal of Science and Technology, 21*(1), 219-229.

Bai, S., Seasotiya, L., Malik, A., Bharti, P., and Dalal, S. (2014). GC-MS analysis of chloroform extract of *Acacia nilotica* L. leaves. *Journal of Pharmacognosy and Phytochemistry, 2*(6), 79-82.

Chukwu, E. C., Osuocha, K. U., Musa, B., and Njoku, J. C. (2022). LC-MS, GC-MS and hematological profile of *Mucuna pruriens* extracts in alloxan induced diabetic albino rat. *International Journal of Biochemistry Research and Review, 31*(1), 54-64.

Cuevas-Glory, L. F., Sauri-Duch, E., Sosa-Moguel, O., and Pino, J. A. (2020). Characterization of odor-active compounds in mango 'Ataulfo' (*Mangifera indica* L.) fruit. *Chemical Papers, 74*(11), 4025-4032.

Divya, B. J., Suman, B., Venkataswamy, M., ThyagaRaju, K., and Raju, K. T. (2017). The traditional uses and pharmacological activities of *Mucuna pruriens* (L.) DC: A comprehensive review. *Indo American Journal of Pharmaceutical Research, 7*(1), 7516-7525.

Duan, X. J., Zhang, W. W., Li, X. M., and Wang, B. G. (2006). Evaluation of antioxidant property of extract and fractions obtained from a red alga, *Polysiphonia urceolata*. *Food Chemistry, 95*(1), 37-43.

Eze, J. I., and Ndukwe, S. (2012). Effect of methanolic extract of *Mucuna pruriens* seed on the immune response of mice. *Comparative Clinical Pathology, 21*(6), 1343-1347.

Gebhardt, S., Lemar, L., Haytowitz, D., Pehrsson, P., Nickle, M., Showell, B.and Holden, J. (2006). *USDA national nutrient database for standard reference, release 21*. United States Department of Agriculture, Agricultural Research Service.

Gouado, I., Schweigert, F. J., Ejeh, R. A., Tchouanguep, M. F., and Camp, J. V. (2007). Systemic levels of carotenoids from mangoes and papaya consumed in three forms (juice, fresh and dry slice). *European Journal of Clinical Nutrition, 61*(10), 1180-1188.

Gupta, A., Mahdi, A. A., Ahmad, M. K., Shukla, K. K., Bansal, N., Jaiswer, S. P., and Shankhwar, S. N. (2011). A proton NMR study of the effect of *Mucuna pruriens* on seminal plasma metabolites of infertile males. *Journal of Pharmaceutical and Biomedical Analysis, 55*(5), 1060-1066.

Harborne, A. J. (1998). *Phytochemical methods: A guide to modern techniques of plant analysis*. Springer Science and Business Media.

Helen, P. M., Aswathy, M. R., Rathi, K. D. R. M., Joseph, J. J., and Sree, S. J. (2013). Phytochemical analysis and anticancer activity of leaf extract of *Mangifera indica* (Kotttukonam Varika). *International Journal of Pharmaceutical Sciences and Research, 4*(2), 819.

Hill, A. F. (1963). *The mango: Botany, cultivation, and utilization*.

Kumar, M., Saurabh, V., Tomar, M., Hasan, M., Changan, S., Sasi, M., and Mekhemar, M. (2021). Mango (*Mangifera indica* L.) leaves: Nutritional composition, phytochemical profile, and health-promoting bioactivities. *Antioxidants, 10*(2), 299.

Kumar, S. V., and Rajeshkumar, S. (2017). Anti-inflammatory, antioxidant, antibacterial effect and phytochemical analysis of *Mucuna pruriens* seed extract. *International Journal of ChemTech Research, 10*(1), 273-283.

Mahattanatawee, K., Manthey, J. A., Luzio, G., Talcott, S. T., Goodner, K., and Baldwin, E. A. (2006). Total antioxidant activity and fiber content of select Florida-grown tropical fruits. *Journal of Agricultural and Food Chemistry, 54*(19), 7355-7363.

Majekodunmi, S. O., Oyagbemi, A. A., Umukoro, S., and Odeku, O. A. (2011). Evaluation of the anti-diabetic properties of *Mucuna pruriens* seed extract. *Asian Pacific Journal of Tropical Medicine, 4*(8), 632-636.

Manyam, B. V., Dhanasekaran, M., and Hare, T. A. (2004). Neuroprotective effects of the antiparkinson drug *Mucuna pruriens*. *Phytotherapy Research, 18*(9), 706-712.

Núñez Sellés, A. J., Agüero, J. A., and Paz, L. N. (2021). GC-MS analysis of mango stem bark extracts (*Mangifera indica* L.), Haden variety: Possible contribution of volatile compounds to its health effects. *Open Chemistry, 19*(1), 27-38.

Osman, C. P., and Ramlan, I. H. (2015). GC-MS analyses of essential oils of three varieties of *Mangifera indica*. *Jurnal Teknologi (Sciences and Engineering), 77*(2).

Parvez, G. M. (2016). Pharmacological activities of mango (*Mangifera indica*): A review. *Journal of Pharmacognosy and Phytochemistry, 5*(3), 1.

Pati, D., Pandey, D. K., Mahesh, R., Kurdekar, V., and Jhadav, H. R. (2010). Anti-depressant-like activity of *Mucuna pruriens*; A traditional Indian herb in rodent models of depression. *Pharmacology Online, 1*, 537-551.

Percival, S. S., Talcott, S. T., Chin, S. T., Mallak, A. C., Lounds-Singleton, A., and Pettit-Moore, J. (2006). Neoplastic transformation of BALB/3T3 cells and cell cycle of HL-60 cells are inhibited by mango (*Mangifera indica* L.) juice and mango juice extracts. *The Journal of Nutrition, 136*(5), 1300-1304.

Pino, J. A. (2012). Odour-active compounds in mango (*Mangifera indica* L. cv. Corazón). *International Journal of Food Science and Technology, 47*(9), 1944-1950.

Rocha Ribeiro, S. M., Queiroz, J. H., Lopes Ribeiro de Queiroz, M. E., Campos, F. M., and Pinheiro Sant'Ana, H. M. (2007). Antioxidant in mango (*Mangifera indica* L.) pulp. *Plant Foods for Human Nutrition, 62*(1), 13-17.

Rodríguez, J., Di Pierro, D., Gioia, M., Monaco, S., Delgado, R., Coletta, M., and Marini, S. (2006). Effects of a natural extract from *Mangifera indica* L., and its active compound, mangiferin, on energy state and lipid peroxidation of red blood cells. *Biochimica et Biophysica Acta (BBA) - General Subjects, 1760*(9), 1333-1342.

Sahu, N., and Saxena, J. (2013). Phytochemical analysis of *Bougainvillea glabra* Choisy by FTIR and UV-VIS spectroscopic analysis. *International Journal of Pharmaceutical Sciences Review and Research, 21*(1), 196-198.

Saikarthik, J., Ilango, S., Vijayakumar, J., and Vijayaraghavan, R. (2017). Phytochemical analysis of methanolic extract of seeds of *Mucuna pruriens* by gas chromatography mass spectrometry. *International Journal of Pharmaceutical Sciences and Research, 8*(7), 2916-2921.

Saikarthik, J., Ilango, S., Vijayakumar, J., and Vijayaraghavan, R. (2017). Phytochemical analysis of methanolic extract of seeds of *Mucuna pruriens* by gas chromatography mass spectrometry. *International Journal of Pharmaceutical Sciences and Research, 8*(7), 2916-2921.

Saleem, M., Tanvir, M., Akhtar, M. F., Iqbal, M., and Saleem, A. (2019). Antidiabetic potential of *Mangifera indica* L. cv. Anwar Ratol leaves: Medicinal application of food wastes. *Medicina, 55*(7), 353.

Shanmugavel, G., and Krishnamoorthy, G. (2018). Nutraceutical and phytochemical investigation of *Mucuna pruriens* seed. *Pharma Innovation Journal, 7*, 273-278.

Siddhuraju, P., and Becker, K. (2003). Studies on antioxidant activities of mucuna seed (*Mucuna pruriens* var. *utilis*) extract and various non-protein amino/imino acids through *in vitro* models. *Journal of the Science of Food and Agriculture, 83*(14), 1517-1524.

Singh, A. P., Sarkar, S., Tripathi, M., and Rajender, S. (2013). *Mucuna pruriens* and its major constituent L-DOPA recover spermatogenic loss by combating ROS, loss of mitochondrial membrane potential and apoptosis. *PloS ONE, 8*(1), e54655.

Singh, R., Singh, S. K., Maharia, R. S., and Garg, A. N. (2015). Identification of new phytoconstituents and antimicrobial activity in stem bark of *Mangifera indica* (L.). *Journal of Pharmaceutical and Biomedical Analysis, 105*, 150-155.

Singh, U. P., Singh, D. P., Singh, M., Maurya, S., Srivastava, J. S., Singh, R. B., and Singh, S. P. (2004). Characterization of phenolic compounds in some Indian mango cultivars. *International Journal of Food Sciences and Nutrition, 55*(2), 163-169.

Weiss, S. J., Takakuwa, K. M., and Ernst, A. A. (2001). Use, understanding, and beliefs about complementary and alternative medicines among emergency department patients. *Academic Emergency Medicine,* 8(1), 41-47.

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